Appendix 3-4 Direction for RCAs and RMOs

(Comparable to UCRB Appendix G)

Contents

Introduction

The information in Appendix 3-4 is an integral element to be used in conjunction with Chapter 3 direction. The appendix information supports and guides the objectives and standards in table 3-5 and is not intended to stand alone.

The first section of this appendix provides an overview of the main components of the aquatic and riparian strategy by alternative. The overview is followed by two sections that further describe, by alternative, two components of the aquatic and riparian strategy: riparian area width delineation termed Riparian Conservation Areas (RCAs), and Riparian Management Objectives (RMOs). Riparian area widths were termed Riparian Habitat Conservation Areas (RHCAs) in PACFISH and INFISH; however, to avoid confusion, riparian area widths are referred to as Riparian Conservation Areas in all alternatives.

Overview of Aquatic and Riparian Strategies

Alternative 1

The basic concept for aquatic and riparian management under Alternative 1 is to rely upon existing direction within Forest Service and BLM land-use plans prior to Decision Notices for PACFISH and INFISH and BLM Statewide bull trout conservation strategies instruction memoranda. This direction varies among land-use plans. Ecosystem Analysis at the Watershed Scale is not required on Forest Service- or BLM-administered lands under Alternative 1. However, Northwest Forest Plan direction would still apply under all alternatives to those areas described by its Record of Decision.

Alternative 2

The strategy for Alternative 2 is based on direction within PACFISH and INFISH and BLM statewide bull trout conservation strategies instruction memoranda. Under Alternative 2, this direction becomes permanent and applies to Forest Service- or BLM-administered lands described within Decision Notices for PACFISH and INFISH and BLM Statewide bull trout conservation strategies instruction memoranda. On Forest Service or BLM-administered lands not described within the Decision Notices or instruction memoranda, management direction is the same as Alternative 1. Aquatic and riparian management goals (described in Chapter 3 Desired Range of Future Condition by alternative), RCAs, and RMOs are the same as those within PACFISH and INFISH. Key and priority watersheds identified for PACFISH and INFISH, respectively, are incorporated into the alternative. Watershed restoration rates would be greater than Alternative 1, and priority will be given to key and priority watersheds.

Ecosystem Analysis at the Watershed Scale is required prior to timber salvage cutting (including fuelwood) or construction of new roads, landings, or recreation facilities within RCAs.

Alternative 3

The Alternative 3 aquatic and riparian strategy emphasizes protection or restoration of watershed processes and functions, aquatic and riparian-dependent species' habitat, and water quality. This

strategy applies to all Forest Service- or BLM-administered lands. Components of the strategy are the following: sub-basin review, Ecosystem Analysis at the Watershed Scale, sub-basin categories (1 through 3), watershed and riparian restoration, RCAs, RMOs, and objectives and standards modified from PACFISH/INFISH. Aquatic and riparian management goals, RCAs, and RMOs are the same as those within PACFISH/INFISH, except that a minimum RCA width of 100 feet is required on either side of intermittent streams. Sub-basin category objectives provide management emphasis for protection or restoration of watershed, riparian, and aquatic processes and functions. Sub-basin review and Ecosystem Analysis at the Watershed Scale provide information to validate broader scale relationships and strategically prioritize ecosystem conservation or restoration management actions. Watershed restoration rates are greater than Alternative 2 but less than Alternative 4.

Ecosystem Analysis at the Watershed Scale shall be completed prior to any activity that requires an environmental assessment or environmental impact statement (1) in Category 1 sub-basins (excluding activities within Wilderness Areas except human-ignited prescribed fires) or (2) within stronghold subwatersheds, bull trout fringe subwatersheds, subwatersheds containing wild populations of steelhead or ocean- or stream-type chinook salmon, or Snake River salmon or bull trout high priority watersheds.

Alternative 4

The Alternative 4 aquatic and riparian strategy emphasis and components are similar to Alternative 3. This strategy applies to all Forest Service- or BLM-administered lands. Components of the strategy are the following: sub-basin review, Ecosystem Analysis at the Watershed Scale, sub-basin categories (1 through 3), watershed and riparian restoration, RCAs, RMOs, and objectives and standards modified from PACFISH/INFISH. Aquatic and riparian management goals are based on PACFISH/INFISH and the Northwest Forest Plan. Forestland RCAs are delineated into zones, and rangeland RCAs are delineated by floodprone width. Two RMO value options, based on PACFISH/INFISH and Aquatic SIT assessment information, are presented for public review and comment. Sub-basin category objectives provide management emphasis for protection or restoration of watershed, riparian, and aquatic processes and functions. Sub-basin review and Ecosystem Analysis at the Watershed Scale are used to provide information to strategically prioritize ecosystem conservation or restoration management actions. This alternative has the highest watershed restoration rate.

Ecosystem Analysis at the Watershed Scale shall be completed prior to any activity that requires an environmental assessment or environmental impact statement (1) in Category 1 sub-basins (excluding activities within Wilderness Areas except human-ignited prescribed fires) or (2) within subwatersheds where federally listed or proposed species or their habitats, or recently occupied or currently accessible habitat for federally listed and proposed species, or populations of steelhead or ocean- or stream-type chinook salmon, would be affected.

Alternative 5

The aquatic and riparian strategy emphasis and components vary among priority areas in Alternative 5. Within timber, recreation, and livestock priority areas, the emphasis is on the protection or restoration of riparian and aquatic processes and functions and water quality while efficiently producing goods and services. Emphasis within aquatic and wildlife priority areas is the same as Alternative 4. Components of the strategy within timber and livestock priority areas are sub-basin review, watershed and riparian restoration, RCAs, RMOs, and objectives and standards designed to meet State and Federal laws. Recreation, wildlife, and aquatic priority areas have the same components as Alternative 4, except that recreation priority areas have different standards specific for recreation management. Aquatic and riparian management goals for all priority areas

are based on PACFISH/INFISH. Timber priority area RMOs and RCAs are determined through site-specific analysis, or through ecosystem analysis if site-level information is inadequate to identify protection of stream input functions. No RMOs or RCAs are identified for livestock priority areas; however, other objectives and standards apply (See table 3-5). Watershed restoration is consistent with priority area emphasis with an overall rate similar to Alternative 3.

Ecosystem Analysis at the Watershed Scale is not required in timber and livestock priority areas.

Alternative 6

Under Alternative 6, the aquatic and riparian strategy emphasis and components, sub-basin review, goals, objectives and standards, RCAs, and RMOs are the same as Alternative 4 except for ecosystem analysis requirements. Watershed restoration rates are slightly less than Alternative 4.

Ecosystem Analysis at the Watershed Scale is required in the following situations:

- prior to any activity that requires an environmental assessment or environmental impact statement in Category 1 sub-basins (excluding activities within Wilderness Areas except human-ignited prescribed fires); or
- prior to any activity that requires an environmental assessment or environmental impact statement in a subwatershed that would affect federally listed, proposed, or candidate species or their habitats; or recently occupied or currently accessible habitat for federally listed and proposed species; or strongholds and fringe populations of redband trout, westslope cutthroat, or Yellowstone cutthroat trout; or
- prior to road density increases in subwatersheds with road densities less than 0.7 miles per square mile; or
- prior to activities that require an environmental assessment or environmental impact statement and that significantly modify large blocks of native rangeland.

After a four-year transition period, Ecosystem Analysis at the Watershed Scale shall be completed on all land administered by the Forest Service or BLM prior to any activity that requires an environmental assessment or environmental impact statement unless exempted by a screening process.

Alternative 7

The aquatic and riparian strategy of Alternative 7 emphasizes protection or restoration of watershed processes and functions, aquatic and riparian-dependent species' habitat, and water quality; it includes a system of large reserves and other unroaded areas larger than 1,000 acres (see Chapter 3, Theme and Design of Alternative 7). Components of the strategy are the same as Alternative 3, 4, and 6 except for the system of reserves and a coarse screening process. Aquatic and riparian management goals are similar to the Northwest Forest Plan. RCA definitions are the same as Alternative 2 except that a minimum width of 150 feet is required on either side of intermittent streams. RMO variables and values are expanded from PACFISH/INFISH based in part on other information as described in the RMO section for Alternative 7. Sub-basin category and reserve management objectives and standards provide management emphasis for protection or restoration of watershed, riparian, and aquatic processes and functions. Sub-basin review and Ecosystem Analysis at the Watershed Scale are used to provide information to strategically prioritize ecosystem conservation or restoration management actions. Overall, this alternative has the lowest active watershed restoration rate.

Ecosystem Analysis at the Watershed Scale is required in the following situations:

- prior to any activity that requires an environmental assessment or environmental impact statement in Category 1 sub-basins (excluding activities within Wilderness Areas except human-ignited prescribed fires); or
- prior to any activity that requires an environmental assessment or environmental impact statement in a subwatershed that would affect federally listed and proposed species or their habitats, or recently occupied or currently accessible habitat for federally listed and proposed species; or
- prior to road density increases in subwatersheds with road densities less than 0.7 miles per square mile; or
- prior to timber harvest in RCAs; or
- prior to management actions in subwatersheds that have more than 10 percent of the area affected by fire; or
- prior to issuing water conveyance permits.

Direction for RCAs and RMOs

RCA widths and RMO values are standards. The mechanism for modifying RCA widths and RMO values varies among alternatives and is identified in standard EM-S13. In Alternative 1, modifications are identified in individual land-use plans. Generally in Alternative 2, RCA and RMO modification will require completion of Ecosystem Analysis at the Watershed Scale to provide the ecological basis for change, but widths and values can be modified in the absence of Ecosystem Analysis at the Watershed Scale where stream reach or site-specific data support the change. In Alternatives 3, 4, 5 (outside timber and livestock priority areas), and 7, RCA widths and RMO values can be changed only after conducting Ecosystem Analysis at the Watershed Scale. In Alternative 6 during the first four years, RCA widths and RMO values can be adjusted with Ecosystem Analysis at the Watershed Scale or with site-specific analysis if conditions in EM-S13 are met. After four years, RCA widths and RMO values can be adjusted only after conducting Ecosystem Analysis at the Watershed Scale. In all alternatives, the following shall be documented: 1) whether standard RCA widths and RMO values were used or whether modifications were made; 2) the rationale for using standard widths or modifications; and 3) the effects of modifications.

Riparian Conservation Areas (RCAs)

Introduction

Riparian systems are water-influenced areas that include streams and other aquatic ecosystems. Riparian Conservation Areas (RCAs) are portions of watersheds where aquatic and riparian-dependent resources receive primary emphasis and where management activities are subject to specific standards and guidelines. Riparian Conservation Areas include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by: (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams; (2) providing root strength for channel stability; (3) shading the stream; and (4) protecting water quality.

In RCAs, maintenance, protection, and restoration of aquatic processes and functions are emphasized and goals and objectives for aquatic and riparian habitats are met. Conservation needs for aquatic and riparian systems can be summarized by the following four principles:

1. A stream requires nutrient inputs and energy to sustain its biological functions.
2. Riparian-associated plants and animals rely on the vegetation adjacent to streams.
3. Small streams are more affected by hillslope processes than larger streams.
4. The likelihood of disturbances resulting in instream effects increases as adjacent slopes become steeper.

Alternative 1

Most existing land-use plans identify riparian area boundaries that focus on water quality and habitat components through application of Best Management Practices. Typically these widths differ among land-use plans.

Alternative 2

In Alternative 2, riparian areas will be delineated in watersheds as described in the Decision Notices for PACFISH (2/24/95) and INFISH (7/28/95) for use on Forest Service-administered lands, and for PACFISH (2/24/95) and Statewide bull trout conservation strategy for BLM-administered lands. Delineation will be as described below. The RCA widths may be increased where necessary to achieve riparian management goals and objectives, or decreased where widths are not needed to attain RMOs or avoid adverse effects to aquatic and riparian-dependent species. Standard RCA widths for the following categories of stream or water body shall be delineated as follows:

Fish-bearing streams: RCAs consist of the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest.

Permanently flowing non fish-bearing streams: RCAs consist of the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site potential tree, or 150 feet slope distance (300 feet, including both sides of the stream channel), whichever is greatest.

Ponds, lakes, reservoirs, and wetlands greater than one acre: RCAs consist of the body of water or wetland and the area to the outer edges of the riparian vegetation, or to the extent of the seasonally saturated soil, or to the extent of moderately and highly unstable areas, or to a distance equal to the height of one site potential tree, or 150 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs, or from the edge of the wetland, pond, or lake, whichever is greatest.

Seasonally flowing or intermittent streams, wetlands less than one acre, landslides, and landslide-prone areas: This category includes features with high variability in size and site-specific characteristics. At a minimum the RCAs must include:

a. the extent of landslides and landslide prone areas.
b. the intermittent stream channel and the area to the top of the inner gorge.
c. the intermittent stream channel or wetland and the area to the outer edges of the riparian vegetation.

d. for key and priority watersheds as defined by PACFISH and INFISH, the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest.
e. for watersheds not identified as key or priority watersheds, the area from the edges of the stream channel, wetland, landslide, or landslide prone area to a distance equal to the height of one-half site potential tree, or 50 feet slope distance, whichever is greatest.

In non-forested rangeland ecosystems, the RCA width for permanently flowing streams, fish-bearing and non fish-bearing, is the extent of the 100-year floodplain.

Alternative 3

RCA delineation is the same as Alternative 2, with the following exceptions:

- RCAs will be delineated for all Forest Service- and BLM-administered lands within the project area (as opposed to only watersheds containing anadromous and native inland fish or bull trout as in Alternative 2).
- All intermittent streams will receive a minimum of 100 feet width on either side of the stream.
- Ecosystem Analysis at the Watershed Scale shall be completed prior to modifying RCA widths.

Alternatives 4 and 6

Ecological functions, processes, and disturbance mechanisms are guides for use and protection priorities in riparian areas. Boundaries between riparian areas and upslopes may need adjustment to address each of the larger scale disturbance effects that may negatively or positively affect unique habitats or sensitive species in riparian environments. The actual size of riparian areas depends on local characteristics that define them; the dimensions of entire riparian areas are not always proportional to the size of aquatic systems.

RCAs are delineated into zones or gradients of influence, with an inner zone (zone 1) where many primary processes and functions occur and an outer zone (zone 2) where processes and functions occur but at different, less important (secondary) levels to the stream channel. The outer riparian zone also functions as a transition and buffer between upslope uses and disturbances and the aquatic environment. Zoning delineates major influence areas, establishing a basis for different levels of disturbance and vegetation management in each zone. This scheme sets the foundation for cumulative effects determination that is spatially-sensitive in considering watershed disturbance.

Although the concept of zones applies to forestland and rangeland environments, it is more difficult to apply in rangelands. For the purposes of this document, zones are delineated only in forested environments. In rangeland environments, floodprone width is used to delineate RCAs.

Forested Lands

Zone 1 is the inner riparian area; it is the primary riparian community and energy influence area. It is most important for protection and maintenance of instream conditions. It also serves to transition processes, functions, and disturbances from streams to floodplains and adjacent riparian areas. Zone 1 is the area most sensitive to land management activities.

Zone 2 is the outer riparian area. It supports additional riparian area processes and functions (for example, microclimate) and also is a buffer area capable of absorbing disturbances from the uplands. It is the interface and transition between the inner riparian area and the uplands. In

steeper landscapes where soils are subject to surface erosion this zone may need extension using the slope adjustment factor. This extended area is referred to as Zone 2b in Table 3-5.

Areas with landslides or that are unstable or landslide prone will also be included in the RCA.

Table 1 displays the dominant processes, functions, and disturbance mechanisms for the two riparian zones in perennial and intermittent stream environments. The table is not inclusive. Perennial and intermittent streams were separated because processes, functions, and disturbance mechanisms for these systems are different. Intermittent streams often have steeper adjacent sideslopes and can be more prone to slope instability.

RCA Delineation Process

RCA delineation is based on three indicators: site potential tree heights (see discussion below), extent of floodprone width, or riparian vegetation width, whichever provides the greatest protection to aquatic and riparian resources.

Site Potential Tree Height (SPTH). The definition of "site potential tree" for purposes of defining widths is: "The average maximum height of the tallest dominant trees (200 years or older) for a given site class" (FEMAT 1993, p.V-34).

The following site potential tree heights shall be used as minimum heights for the three forested potential vegetation groups (PVGs) in the project area.

PVG	Minimum SPTH (feet)
Dry Forest	120
Moist Forest	150
Cold Forest	90

Table 1. Dominant Processes, Functions, and Disturbance Mechanisms for Perennial and Intermittent Streams.

Variables	Perennial/Intermittent Zone 1	Perennial Zone 2	Intermittent Zone 2
Shade for stream temperature	P	S	n/a
Shade for riparian species	P	S	P
Large wood delivery to streams	P	S	P
Large wood delivery to riparian areas	P	P	P
Leaf and other organic matter inputs	P	S	S
Riparian microclimate	P	S	P
Buffer for water quality	P	P	P
Nutrient and energy to streams	P	S	S
Habitat: aquatic species	P	S	S
Habitat: riparian dependent species	P	S	P
Habitat/migration for terrestrial species	P	P	P
Root strength	P	S	S
Soil moisture & temperature	P	S	P
Sediment trapping	P	S	P
Flooding *	P	S	S
Debris flows	P	P	P
Fire*	S	S	P
Insects and Disease *	S	S	P

P=primary emphasis; S=secondary emphasis;
*Primary natural disturbance mechanisms

The average height for dominant trees on any given site is a function of tree capabilities and site quality. Tree capabilities include species and genetic influences. Site quality refers to a complex integration of physical, chemical, and biological elements. The heights presented in the table above are coarse averages based on data (site index tables) from the project area for several different tree species on average to good sites. Local site index tables, species-specific tables, or site-specific data provide more accurate information than these averages. See table 3-5 for direction on modification.

Slope Adjustment Factor. Adjustment of stream RCA widths for slope uses a curve based on probable sediment travel distance from concentrated sources of erosion and sediment from roads (Ketcheson and Megahan 1996). The curve does not predict the volume of sediment reaching a stream or moving a certain distance, but rather predicts probabilities that road-related sediment particles will travel at least as far as the distance calculated using the curve. The curve is based on data from Idaho batholith soils (Ketcheson and Megahan, 1996); it may over-predict erosional processes for less erodible soils and may under-predict sediment transport for finer particles of eroded material.

Other research (Megahan and Ketcheson 1996) found that in addition to slope, other significant predictors of transport distance were sediment volume, amount of obstructions, and source area. Volume alone accounts for 78 percent of the variance in sediment transport distance in the Megahan and Ketcheson data set, and is therefore a useful predictor of risk of sediment travel distance exceedance. Different levels of risk can be defined by varying volumes of sediment according to the distribution of the samples in the Megahan and Ketcheson data set.

The general relationship of slope to sediment travel distance can be used as a simple and universal method of defining zone 2b that is sensitive to slope gradient, as shown in Figure 1. Figure 1 describes sediment travel distance as a function of slope gradient, for median values of obstructions and source area. For this curve the 90th percentile of volume is used to predict the transport distance that is, on average, exceeded only 10 percent of the time for any given slope. While not available prior to publication of the draft EIS, direction for using curves representing other percentiles should be evaluated.

The process for delineation of forested riparian areas (perennial and intermittent streams) involves dividing RCAs into two zones:

A. Minimum Widths for Perennial Streams

Zone 1 equals one site potential tree height, or the extent of the floodprone area, or the extent of wet and moist riparian vegetation, whichever best maintains, protects, and restores the aquatic environment.

Zone 2 equals one site potential tree height or the extent of dry riparian vegetation (zone 2a), plus any width added for slope adjustment using figure 1 (zone 2b).

B. Minimum Widths for Intermittent Streams

Zone 1 equals one-half site potential tree height, or the extent of the floodprone area, or the extent of wet and moist riparian vegetation, whichever best maintains, protects, and restores the aquatic environment

Zone 2 equals one-half site potential tree height, or the extent of dry riparian vegetation (zone 2a), plus any width added for slope adjustment using figure 1 (zone 2b).

C. Additional Requirements Applicable for all Streams

Additional special consideration is necessary where there are landslides and in landslide prone or unstable areas. Landslide prone determination shall be based on the procedure outlined in Tang and Montgomery (1995) or other comparable techniques.

D. Total RCA Width

Total RCA width is the sum of the widths determined from steps A through C.

Example: A perennial stream and an intermittent stream with a 40 percent sideslope, in moist forest (150 foot SPTH), would have the following RCA width:

Perennial Stream RCA: 1 SPTH (zone 1) + 1 SPTH (zone 2a) + 10 (zone 2b) + 0 (landslide prone) = 310 feet (each side of the stream).

Intermittent Stream RCA: ½ SPTH (zone 1) + ½ SPTH (zone 2a) + 160 (zone 2b) + 0 (landslide prone) = 310 feet (each side of the stream).

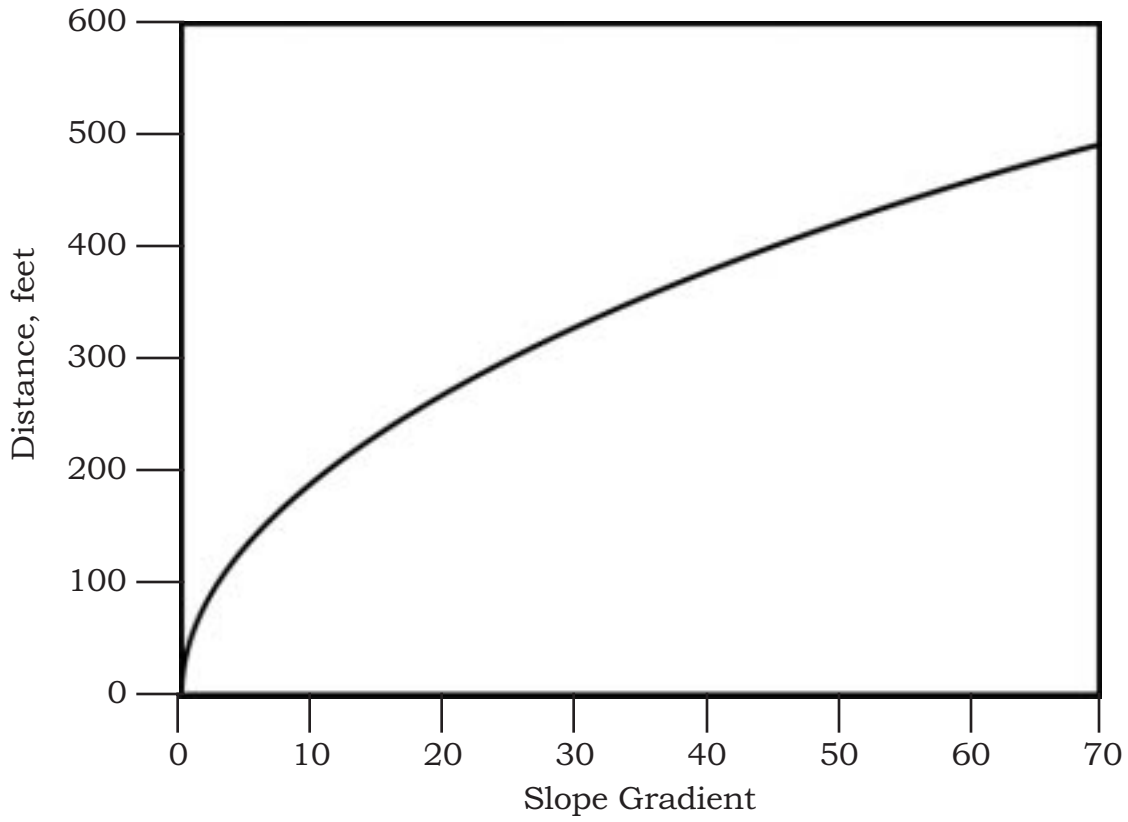

Figure 1. Slope Adjustment for Adding Width (Zone 2b) to Zone 2a for Intermittent Streams

Rangeland Streams

The process of delineation for rangeland riparian RCAs (perennial or intermittent streams) relies on floodprone widths by stream type, or the extent of potential natural riparian vegetation, whichever provides the greater protection to aquatic and riparian resources. Riparian vegetation can be delineated by aerial photographs or field inspection. Floodplain area is essentially equivalent to floodprone width defined by Rosgen (1994).

The following steps can be used to determine the floodprone area. It is suggested that field units develop relationships between bankfull width and drainage area or use existing relationships for their area.

1. Determine bankfull width for the drainage area above the point on the stream.
2. Determine the stream type using Rosgen stream types (Rosgen 1994) from aerial photographs or existing classification data.

3. Select the entrenchment ratio (ER), which is the average maximum, for the particular stream types (level I) from the following:

Stream type	A	B	C	E	F	G
Entrenchment Ratio	1.4	2.2	5.3	56.9	1.2	1.3

   Because entrenchment ratio is non-applicable in D streamtypes (braided systems), riparian width shall be determined on a case by case basis using site-specific or local information.

4. Calculate the floodprone area by multiplying the bankfull width and entrenchment ratio.

Local drainage area and bankfull width relationships should be used in place of figure 2. Likewise, if field verified entrenchment ratios are known, this data should also be used in place of the average maximums shown in step 3.

Example: A stream which has a drainage area of 100 square miles has an estimated bankfull width of 45 feet (figure 2 (Emmett 1975)). The stream type is known to be an C from classification data. The average maximum entrenchment ratio, or ER, for a C is 5.3. Multiplying the ER by the bankfull width (45 X 5.3) equals a floodprone width of 238 feet (for each side of the stream).

Forested Land and Rangeland Ponds, Lakes, Reservoirs, and Wetlands

RCAs for ponds, lakes, reservoirs, and wetlands greater than one acre consist of:

- the body of water or wetland and the area to the outer edges of the riparian vegetation, or
- the extent of the seasonally saturated soil, or
- the extent of moderately and highly unstable areas, or
- a distance equal to the height of one site potential tree, or
- 150 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond or lake, whichever is greatest.

For ponds, lakes, reservoirs, and wetlands less than one acre, the above RCA delineation shall apply, except that the minimum slope distance shall be 100 feet.

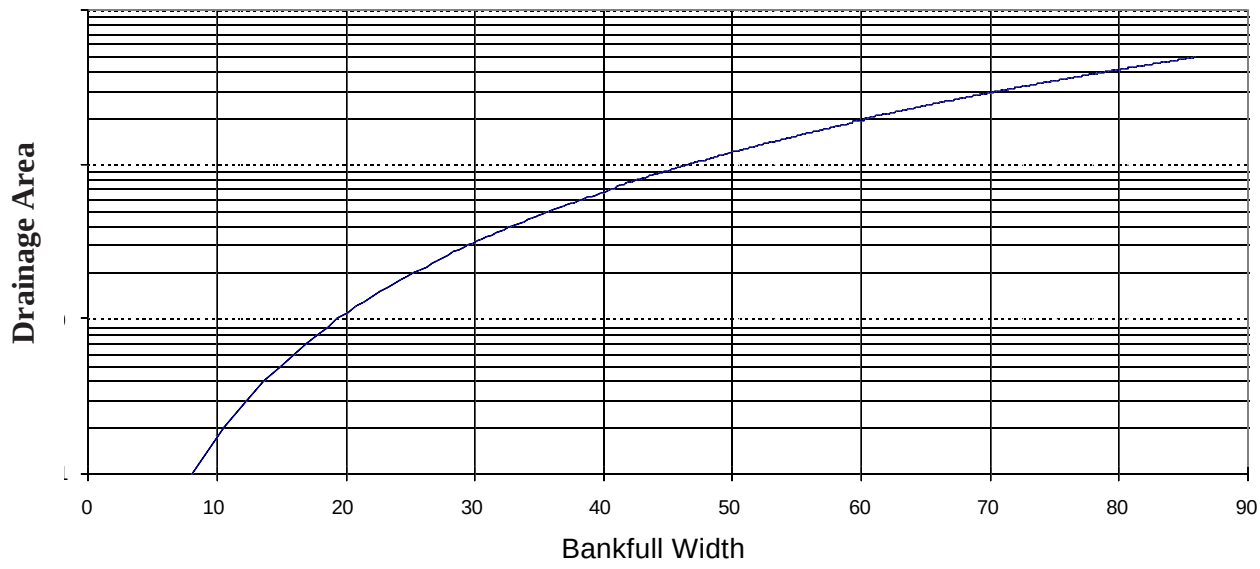

Figure 2. Relationship Between Bankfull Width and Drainage Area.

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Alternative 5

RCA width varies among priority areas.

Timber and livestock priority areas. In forested potential vegetation groups, RCA widths are based on the maximum needed to provide for individual stream input processes, and are defined by table 2. Functions requiring protection are determined by site-specific analysis, and by ecosystem analysis only if site analysis does not provide the necessary information.

In rangeland potential vegetation groups, no specific RCAs are delineated; however, there are requirements in table 3-5 for Proper Functioning Condition (PFC) and maintenance and protection of water quality.

Other priority areas. RCA delineation as described under Alternative 4 shall apply.

Alternative 7

Delineation of RCA widths are the same as for Alternative 2 with the following exceptions:

- All intermittent streams require 150 feet minimum width.
- Ecosystem Analysis at the Watershed Scale is required prior to changing any standard width.

Table 2. RCA Widths, Timber Priority Areas, Alternative 5

Function	Medium to Large Streams	Small Streams
Water/Bank Stability: Constrained Channels	Up to 20 feet	Up to 20 feet
Water/Bank Stability: Unconstrained Channels	Up to 1 effective tree height around all active channel migration zones	Up to 1 effective tree height around all active channel migration zones
Canopy	Up to 75 feet around all active channel migration zones	Up to 75 feet around all active channel migration zones
Large Woody Debris	Up to 1 effective tree height around all active channel migration zones	50 feet around all active channel migration zones
Litter	100 feet around all active channel migration zones	50 feet around all active channel migration zones
Nutrients	100 feet around all channels if of concern to anadromous fish	50 feet around all channels if of concern to anadromous fish
Sediment from Surface Erosion	Roads: 150 feet; Ground-based skidding: 50 feet	Roads: 150 feet; Ground-based skidding: 50 feet
Inner Gorge Sediment from Mass Failures	High-risk sites identified through land type inventories for each forest	High-risk sites identified through land type inventories for each forest
Gravel	Bank erosion and mass failure sites identified site specifically	Bank erosion and mass failure sites identified site specifically

SOURCE: Northwest Forest Resources Council 1995.

Riparian Management Objectives (RMOs)

Introduction

Riparian Management Objective (RMO) values for stream channel conditions, when used in combination with objectives of the Interior Columbia Basin Ecosystem Management Project (ICBEMP), provide criteria to help assess attainment of aquatic and riparian goals as described in the Desired Range of Future Conditions (DRFC; see Chapter 3). These values provide a description and characterization of watershed, riparian, and stream channel processes and existing conditions that can be used to guide management activity design, implementation, and monitoring. RMOs are not expected to be met instantaneously but rather would be achieved over time.

As indicated below, some RMOs apply to forested ecosystems, some to rangeland ecosystems, and some to all ecosystems. Actions that reduce habitat quality are inconsistent with the purpose of ICBEMP direction. However, the intent of RMOs are not to establish a ceiling for what constitutes good habitat conditions. The following statements provide the intent for use of the RMOs and their purpose in a comprehensive conservation program:

1. RMOs are criteria to help evaluate progress towards attainment of watershed, aquatic and riparian goals described within the DRFC.
2. Interim RMOs are not to be viewed as independent from other components of the aquatic conservation strategy; rather, they are part of an aquatic conservation program. RMOs are not always sensitive to immediate effects but rather exhibit response to cumulative effects and factors influencing channel history over time.
3. Interim RMOs do not replace State and Federal water quality standards promulgated under Federal Clean Water Act or State laws, but they should complement these standards in providing measurable habitat attributes.

Procedure for RMO Application

RMOs apply to all perennial streams during those times that the streams support aquatic life. Effects of land management activities on intermittent streams may influence the attainment of RMOs in perennial streams. All instream and riparian variables should be used, in combination, to provide a comprehensive synopsis of watershed, riparian, and aquatic conditions, since placing emphasis on interpretations of individual variables may lead to erroneous conclusions related to watershed, riparian, and aquatic conditions.

RMO application or development can follow these steps:

1. The values apply where ecologically attainable. Locally developed RMOs supported with information from ecosystem analysis is preferred because of the variable nature of streams within the project area. Stream conditions can vary from disturbances and channel evolution histories that influenced channel form and conditions. It is recommended that National Forest and BLM managers conduct their own analyses due to the variable conditions in the project area. Managers should consider using similar techniques described by Overton et al. (1995) to define appropriate RMOs. Riparian Management Objectives should be developed from evaluation of reference conditions in similar landforms, climate, stream type and valley bottom settings, and potential vegetation. In all cases, the rationale supporting these changes, and the effects of the changes shall be documented.

2. Use information from step 1 to develop management actions for conserving or restoring watershed, riparian, and channel processes.
3. Monitor implementation and effectiveness of management actions to determine if they have the intended results. Provide feedback information for future management objectives, actions, and evaluation of RMOs.

Alternative 1

Most existing land-use plans identify aquatic and riparian habitat variables that are used to measure condition and assess attainment of land-use plan goals and objectives. Typically, these variables differ among land-use plans.

Alternatives 2 and 3

In PACFISH (2/24/95) and INFISH (7/28/95), landscape-scale RMO values describing good habitat for anadromous and inland native fish were developed, using stream inventory data for pool frequency, large woody debris, bank stability, lower bank angle, and width-to-depth ratio. Applicable published and non-published scientific literature was used to define favorable water temperatures. All of the described habitat features may not occur in a specific segment of stream within a watershed, but all generally should occur at the watershed scale for stream systems of moderate to large size (3rd to 6th order).

Riparian Management Objective values represent a good starting point to describe the desired condition for fish habitat. National Forest and BLM managers are encouraged to establish site-specific RMOs. Riparian Management Objectives should be refined to better reflect conditions that are attainable in a specific watershed or stream reach based on local landform, climate, stream type and valley bottom settings, and potential vegetation. Modification of RMO values in Alternative 2 requires completion of Ecosystem Analysis at the Watershed Scale or site-specific analysis to provide the ecological basis for the change. In Alternative 3, modification of RMO values requires completion of Ecosystem Analysis at the Watershed Scale. In all cases, the rationale supporting these changes and the effects of the changes shall be documented.

Riparian Management Objective values for six environmental features are identified in table 3. These features are good indicators of ecosystem health, are quantifiable, and are subject to accurate, repeatable measurements.

Alternatives 4 and 6

RMO values for Alternatives 4 and 6 describe watershed-scale (5th- to 6th-field HUC) habitat conditions for both EIS planning areas within the Interior Columbia Basin Project area. Attributes are divided into two categories: Instream variables and riparian vegetation. Two options for some RMO values are presented here for public review and comment.

In Alternative 4, modification of RMO values requires completion of Ecosystem Analysis at the Watershed Scale. In Alternative 6, Ecosystem Analysis at the Watershed Scale or site-specific analysis can be used to modify RMO values if the change results in equal or greater protection to aquatic and riparian-associated species. Standard EM-S15 describes modification conditions and procedures. The values in Tables 4 and 5 shall apply if ecosystem analysis or site-specific NEPA analysis is not completed.

Table 3. RMO Values for Alternatives 2 and 3

Habitat Feature	Values									
Pool Frequency (all systems) Varies by channel width.	Wetted width (feet)	10	20	25	50	75	100	125	150	200
	Pools per mile	96	56	47	26	23	18	14	12	9
Water Temperature	No measurable increase in maximum water temperature (7 day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7 day period). Maximum water temperatures below 59°F within adult bull trout holding habitat and below 48°F within bull trout spawning and rearing habitats. Maximum water temperatures below 64°F within anadromous fish migration and rearing habitats and below 60°F within anadromous fish spawning habitats.									
Large Woody Debris (forested systems)	> 20 pieces per mile; > 12 inch diameter; > 35 foot length.									
Bank Stability (rangeland systems)	> 80 percent stable.									
Lower Bank Angle (rangeland systems)	> 75 percent of banks with <90 degree angle (i.e., undercut).									
Width/Depth Ratio (all systems)	< 10, mean wetted width divided by mean depth									

Procedure for Determining Riparian Vegetation RMO

Functionality of aquatic and riparian environments can be more fully evaluated with the inclusion of riparian vegetation. Riparian vegetation is generally more sensitive to immediate effects from management activities. In some vegetation and valley bottom settings, riparian vegetation can be responsive to restoration in short timeframes. Most instream RMOs are dependent upon riparian vegetation condition; therefore, a riparian vegetation RMO was included for Alternatives 4 and 6.

The following steps summarize a method to assess similarity of current riparian vegetation to potential riparian vegetation based on information presented within the ICBEMP area. The *Riparian Plant Association Groups and Associated Valley Bottom Types of the Columbia River Basin* (Manning and Engelking 1995) should be used to determine the riparian vegetation RMO. See figure 3 for a complete display of the five steps for assessing similarity.

1. Identify the Potential Vegetation Group (PVG) in which the riparian area occurs (for example, dry forest).
2. Compare the existing vegetation with the probable riparian vegetation to assess how similar or dissimilar the existing riparian vegetation is to the potential.

The existing riparian vegetation should be at least 60 percent similar to the potential vegetation to meet the RMO. If there is less than 60 percent similarity and it is not attributable to absence of the potential riparian vegetation group within the valley bottom setting, then management actions that move riparian vegetation toward the potential should occur.

Table 4. RMO Values for Alternatives 4 and 6

Category	Values (Applicable where ecologically attainable)[1]								
I. Instream Variables									
Option A									
Large Pool Frequency	To be developed								
Pool Frequency (all systems) Varies by channel width.	Wetted width (feet)	10	20	25	50	75	100	125	150	200
	Pools per mile	96	56	47	26	23	18	14	12	9
Pool Depth/Width	To be developed									
Large Wood Frequency (forested systems)	> 20 pieces per mile; > 12 inch diameter; > 35 foot length.									
Fine Sediment	< 20% surface fine sediment (6.4 mm) in spawning habitat or < 30% cobble embeddedness in rearing habitat.									
Option B									
Large Pool Frequency Pool Frequency Pool Depth/Width Large Wood Frequency (forested systems) Single Wood Frequency (forested systems) Fine Sediment	**See Table 5 for values**									
Bank Stability (non-forested systems)	>80 percent bank stability in ERUs 1-12 >90 percent bank stability in ERU 13 (Overton et al. 1995)									
Temperature	For waters supporting cold water beneficial uses - except bull trout habitat and salmonid spawning, incubation, and fry emergence - the maximum temperature will be below 64°F. In waters supporting salmonid spawning, incubation, and fry emergence except bull trout, the maximum temperature will be below 55°F for the specific times of the year when these uses occur. In waters supporting bull trout habitat the maximum temperature will be below 50°F, except for those periods of spawning to fry emergence when the maximum temperature will be below 48°F. All temperatures will be measured as a 7-day moving average of daily maximum temperature.									
II. Riparian Vegetation	Applies to all forest and range riparian areas: mature and old forest, and late ecological status range riparian conditions adapted to fire regimes and other disturbances characteristic for the site. Riparian vegetation RMOs should be measured by the percent similarity of current riparian vegetation to the mature forest and late ecological status range riparian community/composition. The percent similarity shall be greater than 60 percent (USDA 1992). The stepwise procedure for determining similarity is outlined in figure 3 and in the riparian vegetation RMO discussion.									

[1] Where values are not ecologically attainable, data and rationale to support this conclusion shall be documented. RMOs values shall be met as closely as ecologically possible.

Table 5. Instream RMO values for Option B*.

EIS Area[1]	Slope Class	Large Pools Per Average Riffle Width[2]		Pools Per Average Riffle Width[3]		Mean Max Depth/Pool Width		Large Wood Per Average Riffle Width[4]	
		Percentile							
		50	75	50	75	50	75	50	75
EEIS	<2%	0.01	0.04	0.04	0.09	0.16	0.19	0.06	0.16
	>2%	0.01	0.04	0.03	0.07	0.21	0.27	0.07	0.21

Fine sediment Surface fine sediment levels shall be developed by local field units for their area.

Interims for ERU 13 only: Mean surface fines (<6.0 mm) as measured in pool tails and low gradient riffles, are described in Overton et al. (1995):

Channel Type	Plutonic Geologic Type	Volcanic Geologic Type	Metamorphic Geologic Type
A	26	25	14
B	23	27	16
C	37	17	no data, development by local field units

* Note: The range of RMO values for the Eastside and UCRB EIS areas are displays of the 50th and 75th Percentile for natural and near natural stream data distribution. All values except pool width/mean maximum depth are normalized by stream width. Riparian Management Objectives values greater than or equal to the 50th percentile met the standard where ecologically attainable. Where values are not ecologically attainable, data and rationale to support this conclusion shall be documented. Riparian Management Objective values will be met as closely as is ecologically possible. To calculate large pools, pools, large wood, and single wood per mile from table values, use the following conversion: number per mile = (table value) x5280/average riffle width in feet.

[1] Data is not continuous over the entire project area particularly for ERUs 10, 11, and 12. Caution should be used when making interpretations from values in these areas. It also should be noted that most stream inventory data was collected from forested stream systems and may not be applicable to rangeland stream systems.

[2] The number of pool channel units with a maximum depth greater than 0.8 m (2.6 feet) and surface area greater than 20 m^2 (215 ft^2) per the reach mean riffle width.

[3] The number of pool channel units per reach mean riffle width.

[4] The number of pieces of wood per reach mean riffle width, surveyed with the USFS Pacific Northwest Region stream inventory protocol. Tallied wood includes all pieces with diameters greater than 20 inches and lengths greater than 35 ft. These values should only be used as a reference condition in forested landscapes in eastern Washington and eastern Oregon.

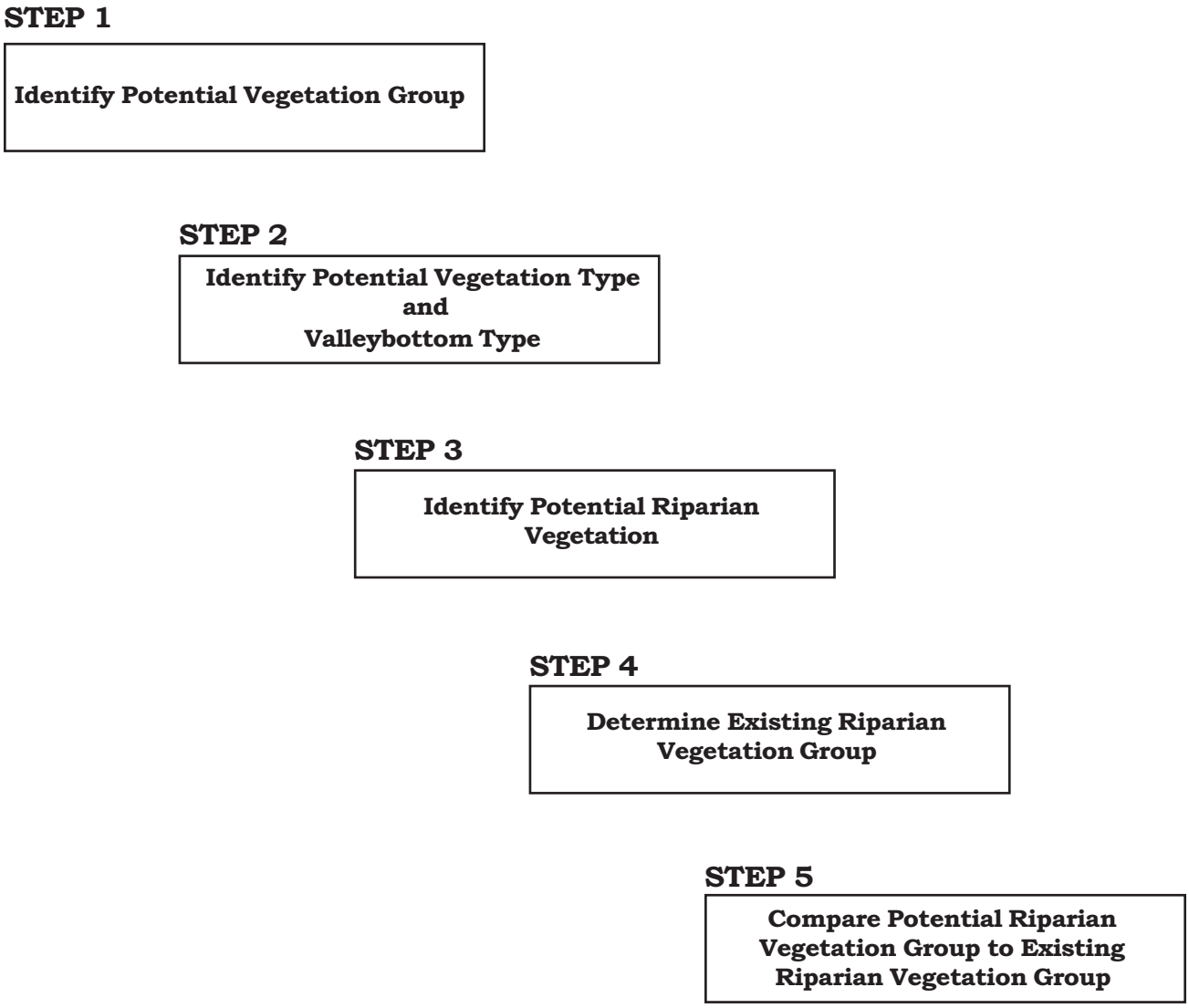

Figure 3. Stepwise Summary for Determining Riparian Vegetation RMOs.

Alternative 5

Timber Priority Areas Within Forested Environments

RMOs are defined not on the basis of instream standards but on the basis of key channel and habitat characteristics in the watershed of concern, and they are locally developed. These measures are then compared with those from streams of highly similar channel and watershed geomorphic character that are judged to fully support the waters beneficial uses, in order to produce reference conditions. Determination of "fully support" must include documentation of assumptions on which judgements are based, allowing for revision over time as new information becomes available. Benchmarks based on the reference conditions can then be established for instream characteristics and remeasured over time to evaluate change.

A benchmark-based system for developing RMOs can be summarized as follows:

a. Existing riparian conditions are measured and compared with reference conditions, where possible, to establish benchmarks.

b. Prescriptions (site-specific standards) are developed to ensure high levels of function even when the relationship of existing conditions to natural or reference conditions remains uncertain.

c. Monitoring is conducted in an adaptive management framework in order to answer four key questions: (1) Was the situation diagnosis correct? (2) Was the prescription correct? (3) Was the prescription implemented? (4) Was the prescription effective? See Appendix 3-1 for more detail.

In summary, RMOs relevant to each stream input process of concern are integrated into the analysis and subsequent management decision-making system.

Livestock Priority Areas Within Rangeland Environments

Riparian Management Objectives are to be based on the definition of Proper Functioning Condition as follows:

Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to:

- dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality;
- filter sediment, capture bedload, and aid floodplain development;
- improve flood-water retention and ground-water recharge;
- develop root masses that stabilize stream banks against cutting action;
- develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and
- support greater biodiversity.

Other Priority Areas

Riparian Management Objectives values as described for Alternatives 4 and 6 will apply to other priority areas.

Alternative 7

Riparian Management Objectives provide a measure of whether land management practices are providing watershed and habitat characteristics that will support aquatic species. If conditions at the watershed scale or site-specific scale are below these criteria, then it must be determined why the watershed is not meeting objectives. Where land management activities are the cause for not meeting riparian management objectives, strategies need to be implemented to restore watershed condition.

These RMOs are based in part on information from PACFISH, the NMFS PACFISH Biological Opinion (USDC 1995a) and the NMFS Land and Resource Management Plans Biological Opinion (USDC 1995b), Rhodes et al. (1994) and Peterson et al. (1992). These RMO values were based on the biological habitat requirements of fish and aquatic resources or based on conditions in undeveloped watersheds. The method of adjusting RMO values is through Ecosystem Analysis if it shows that habitat recovery is enhanced and not retarded. Below are RMOs for sediment delivery, fine sediment, and cobble embeddedness. In addition, modifications to PACFISH/INFISH RMOs are listed below for streambank stability and temperature. All other PACFISH/INFISH RMOs as described for Alternative 2 apply.

1. *Sediment Delivery Standard*: Reduce delivery of sediment to streams to no more than 20 percent over natural from all anthropogenic sources in watersheds containing current or

historical spawning or rearing habitat, unless it can be shown through Ecosystem Analysis based on peer reviewed science that stream habitat conditions can improve and that substrate and pool standards can be met with a different sediment standard.

2. *Fine Sediment Standard*: Limit stream surface fine sediment (less than 6.4 mm in diameter) averages to less than 20 percent in spawning habitat.
3. *Cobble Embeddedness Standard*: Limit stream cobble embeddedness to less than 30 percent in rearing habitat.
4. *Bank Stability Standard*: Ninety percent of all stream banks should be in a stable condition.
5. *Water Temperature Standard*: For waters supporting cold water beneficial uses, except bull trout habitat and salmonid spawning, incubation, and fry emergence, the maximum temperature will be below 64^0 F. In waters supporting salmonid (except bull trout) spawning, incubation, and fry emergence, the maximum temperature will be below 55^0 F for the specific times of the year when these uses occur. In waters supporting bull trout habitat the maximum temperature will be below 50^0 F, except for those periods of spawning-to-fry emergence, when the maximum temperature will be below 48^0 F. All temperatures will be measured as a seven-day moving average of daily maximum temperature.

Coarse Screening Process

The coarse screening process will be used at a watershed scale (5th- to 6th-field HUC) to determine the consistency of activities with the goals of conserving and improving aquatic habitat. In some situations it may be desirable to apply the coarse screening process at smaller or larger scales because of habitat use or environmental conditions within the watershed. The screening process employs three sets of filters to assess the consistency of land management activities with conservation and improvement of aquatic habitat:

- in-channel criteria (surface fine sediment, cobble embeddedness, streambank stability, and temperature);
- land management criteria (sediment delivery, RCAs, timber harvest, grazing, roads, and aquatic reserves); and
- data availability.

Generally, activities should be considered to be consistent with the conservation and improvement of aquatic habitat when it complies with all aspects of the filters. Figure 4 represents a flow for the coarse screening process.

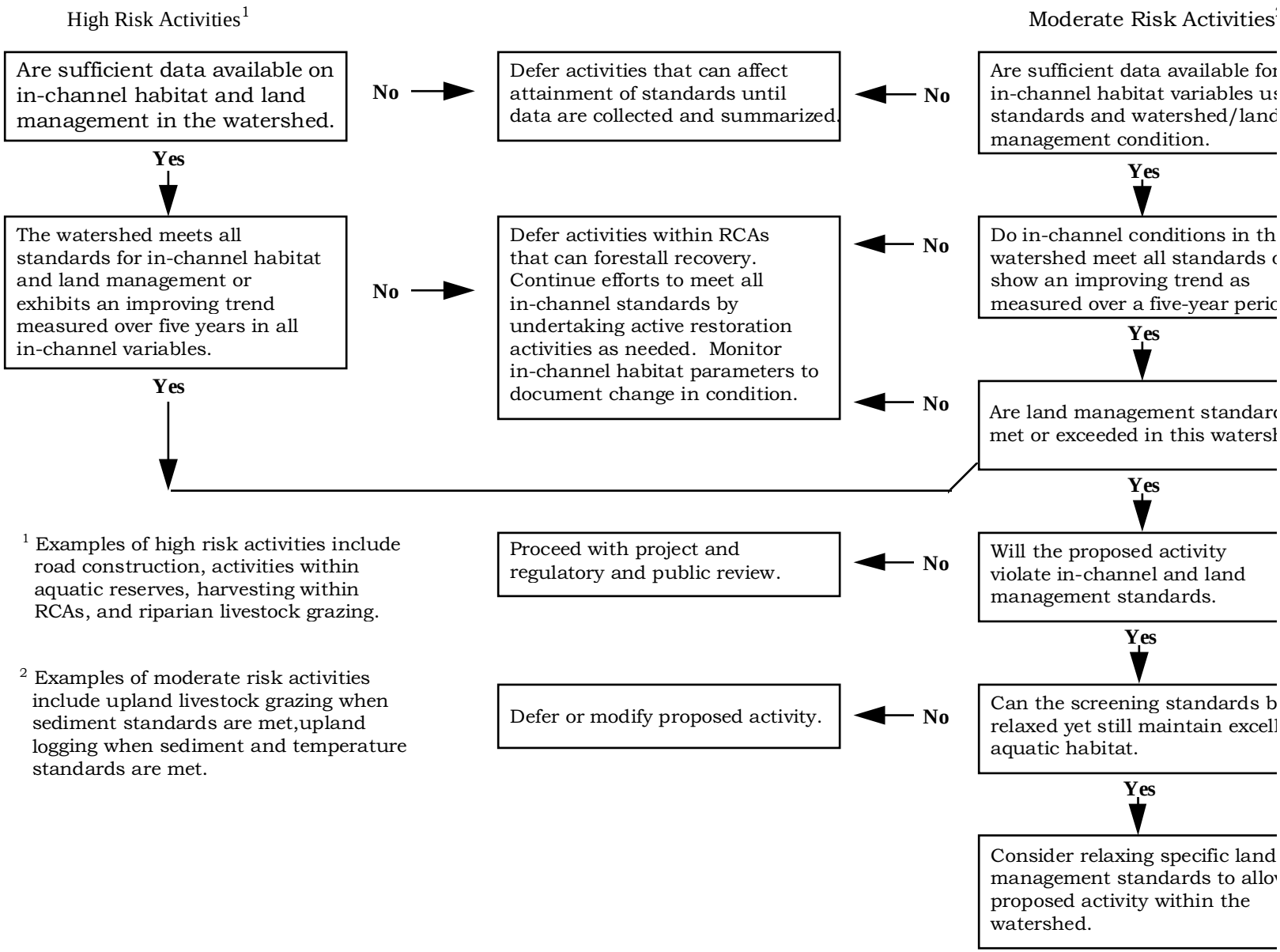

Figure 4. Coarse screening process for proposed activities (adapted from Rhodes et al. 1994)

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